

erweitert und auf der Rippe 6 gebrochen bzw. hinter dieser Rippe wurzelwärts verschoben, während sie vor der Rippe 8 wurzelwärts erweitert ist. Die Ausbuchtung des Hinterrandes der Vorderflügel ist wie bei *Gastropylakaeis forficulatus* mit langen, schwarzen Schuppenhaaren besetzt. Fransen ein klein wenig heller als die Flügelfläche. Hinterflügel mit Fransen oben und unten einfarbig blaßgrau mit schwachem, gelblichem Schimmer. Vorderflügel unten wie die Hinterflügel, in der Costalhälfte mit einem braunen, submedianen und subapicalen Querwisch. — Thoraxrücken wie die Vorderflügel, seitlich jedoch heller; der Hinterleib ist wenig dunkler als die Vorderflügel. — Flügelspannung 30, Flügellänge 15, Körperlänge 18 mm.

Das ♀ ist größer (bzw. 36, 20, 15,5 mm) und heller gefärbt, die Hinterflügel weißlich, Vorderflügel etwa olivengraugelblich mit Andeutung derselben Zeichnungen wie beim ♂; der Discozellularfleck tritt noch schärfer hervor, weil seine Umgebung heller ist. Unten zeigen die Vorderflügel fast gar keine Spuren von Zeichnungen. — Das ♀ erinnert an *Taragama diluta* Auriv.

Die typischen Exemplare (2 ♂♂, 3 ♀♀) gehören dem Kgl. Zoolog. Museum Berlin.

Thoughts on the Hymenoptera Trichogrammatidae with Corrective Notes and Criticism.

By

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1. A Reexamination of *Brachistella* Girault and the General Principle of Classification.

The classifications¹⁾ of the family *Trichogrammatidae* so far given have caused much confusion in our mind concerning the taxonomic value of the ciliation of the fore wings. One will find series of genera changing gradually from the peculiar arrangement of the discal cilia in lines to the usual dense, irregular ciliation of other Chalcidoids. Also one will find a series of species agreeing in structure and so on, evidently closely related but where also the graduate change from one kind of ciliation to the other can be observed. *Abbella* Girault and *Brachistella* Girault form such a group of species. All their fundamental structures are alike: the antennae have the same shape and

¹⁾ For a new arrangement of the genera, see Memoirs Queensland Museum, Brisbane, I, 1912.

segmentation, the venation is similar, the wings are similar in everything but discal ciliation, the body is nearly alike, differing slightly in size. The only difference between the two genera is this: In *Brachistella* the discal ciliation of the fore wings is normal, that is, dense enough so that no regular lines of ciliation are observable; but in *Abbella* this ciliation is noticeably less dense so that a half dozen or more regular and long lines become prominent, the rest of the ciliation, irregularly placed in more or less dense patches between these lines around the wing's apical margin. If one will examine *Trichogramma*, a genus typical of those bearing the radiating arrangement of the ciliation, although it will be seen that the alignment of the ciliation is more distinct and prominent, yet the same irregular patches of the ciliation is more distinct and prominent, yet the same irregular patches of the ciliation are between the lines near the apex. Around the apex of the fore wing in *Abbella*, the straight lines are hardly discernible from the rest of the ciliation. Thus, the change from normal ciliation to that of radiating lines is merely a change of density in ciliation and we have reason to doubt the value placed upon it for taxonomic purposes, since it is so gradual, continuous and noncorrelated. In many genera of the allied *Aphelininae* the relative density of the discal ciliation is a specific character and this is true for genera of the *Myrmariidae*.

Though it is a general principle in taxonomy that „the less any part of the organization is concerned with special habits, the more important it becomes for classification“ or the less adaptive a part, the more its importance (since it would of necessity be less variable and more constant, not changing with a change of habit), yet there are numerous exceptions and this variability of the wing ciliation is one of them. Discal ciliation of the fore wing is certainly not an adaptive character, since it may be entirely absent or very sparse (species of *Oligosita*) without change of habit and because we are unable to see what particular use it may be in this case, as an adaptive character. Surely, because *Trichogramma* has a different arrangement of hairs on its fore wings than has *Tumidifemur* we would not be justified merely upon that ground, in inferring that the two genera differ in habit; experience would not lead us to connect the two, since it would soon shew that the occurrence of one kind of ciliation was not always followed by the occurrence of one kind of habit (*Tumidifemur* and *Trichogrammatella* have opposite sets of ciliation but both are parasitic upon the same host). Moreover, it is a general taxonomic principle that organs of high physiological importance are of great value, but again with this principle, if it may be so called, there are numerous exceptions. We are lead, therefore, to the conclusion that the classification of any group whatsoever is dependent not upon characters valued in reference to their function or their form but upon characters in reference to their relationship and broadly speaking, this will be found to depend on variability or nonvariability, since the theory of descent makes it necessary that stable characters are those which have been handed

down through a common heritage. In the classification of any group, whether of genera or larger segregates, there is an underlying principle that of common descent, which expresses itself in the comparative stability of various characters. If a character is constant it takes high taxonomic value, whatever the nature of the part may be. Its value is distinctly dependent upon the number of species or genera it is uniform and constant for and also in its being correlated with other constant characters. The theory of descent with modification also shews why an aggregate of characters is of still greater importance in classification, since it is clear that several constant characters give greater evidence of common blood relationship. It is impossible for a character to be constant in a group without its being evidence that the included species are akin. Classification then is a matter of evidence of relationship between species and their groupings. On this view we cannot conclude otherwise than that there are natural genera.¹⁾

The classification of the *Trichogrammatidae* must be based upon the principle stated and therefore I have taken constancy of a character or of characters as an index of a natural or true grouping of the genera. There is no character which is constantly correlated with others. Thus all the members of the family so far known either have curved or straight venation, but neither kind of venation is correlated with any other character; all the members of the family have wings whose discal ciliation is either normal and dense or else arranged in regular lines and less dense and with neither kind of ciliation is there correlation²⁾; all members of the family bear antennae which are either with or without a funicle, but neither division thus formed has correlated characters; and all members of the family either do or do not bear exerted ovipositors but neither those which do or those which do not bear any other distinctive character excepting that most genera that do, have the ciliation arranged in regular lines. There is no other distinctive character excepting that all genera with normal, dense ciliation do not bear an oblique line of discal cilia from the stigmal vein (but there are several unlike genera with regular lines of ciliation not possessing the oblique line of cilia, e. g. *Tumidiclava*, most species of *Abbella*, the species of *Trichogrammatoidea*, *Lathromeris* and *Uscanella*; this cannot be considered a correlation). Thus there is no other operation necessary in this case than a determination of the relative taxonomic value of these four characters as expressed in their constancy. Let us examine the last first. The presence of an exerted ovipositor is least in importance of the characters named, since firstly, it is a character of an adaptive nature as in *Poropoea* and *Ophioneurus* which deposit

¹⁾ How are we going to deny that genera are natural? They are born in nature like variations and species are. There are natural orders as there are natural varieties. To deny one is to deny the other, since to deny a whole made up of similar parts, granted to be natural, is to deny nothing.

²⁾ One Australian genus is an exception, the ciliation irregular and not very dense; its ciliation is exceptional.

their eggs into a covered and concealed host and hence need a longer ovipositor than usual; secondly, it is not constant, not occurring with a large number of species; and thirdly, of itself, its length varies greatly; and fourthly it is present in very unlike genera, which obviously are not closely related. The third character, the presence or absence of the antennal funicle, I consider second in importance of the four because the antennae are of high physiological importance, the presence or absence of the funicle is not adaptive in nature, is constant for a large number of closely related species and for the group is not very variable; moreover, the antennae themselves, as regards their segmentation, are not variable with species. In regard to the discal ciliation of the fore wings, another unadaptive character, I think we may conclude with safety that it ranks third in order of importance, for it is variable in closely allied genera, one kind of ciliation is present in very unlike genera, an arrangement of genera on its basis leads to parallelism where divergence it seems would be expected, in some genera it is indeterminate and even disappears (in *Oligosita* it may be either dense and normal, sparse, faint and in lines, or totally absent, thus becoming a specific character); more than this, its variation is gradual. This character, therefore, must be valued as less than the presence or absence of the antennal funicle, since it is less constant and accordingly we must not assign to it more than generic importance. The first character thus takes precedence; firstly, the kind of venation is constant for a largest number of like genera; secondly, venation itself is nonadaptive; and thirdly, it shews no continuous or gradual variations between the two kinds; finally, arrangement of genera with its aid gives divergence and fulfils the expectations. Still more than these is the impression given of natural evolutionary processes, development from straight venation to curved. Thus, of the genera of the group so far known, it appears that the kind of venation is constant for the largest number, the segmentation of the antennae for the next largest and the other characters — exerted ovipositor and discal ciliation of the fore wing — being subordinate and characteristic only of unlike genera. We must thus reduce the latter character to a generic basis.

There is still one other character in the *Trichogrammatidae*, of rare occurrence, of importance neither physiologically nor adaptively but which at first thought one might take to possess relatively high taxonomic value. This character is a median sulcus of the mesothorax¹⁾, common in eulophid genera but rare with this group. Of the known genera, it occurs only in *Ittys* Girault and two Australian genera just described, perhaps in *Trichogrammatoidea lutea* and in one species of *Oligosita* (a very minute Australian species). These genera are all closely related; all bear straight marginal veins and the antennal funicle is present. But of these genera, excepting *Oligosita*,

¹⁾ In *Ittys*, one of the Australian genera and the *Oligosita* at least, running along all of the thorax to the end of the long phragma.

only the type species are known. In the numerous species of *Oligosita* (there are eleven species occurring in Australia), it occurs only in the unique species noted. Thus, it is not constant for a large number of species and in this case we should hesitate to call it of generic value, even though in the *Oligosita* it is correlated with the absence of the prominent spinelike seta from the apex of the antenna and also with minuteness. But the species is obviously an *Oligosita*, agreeing in an aggregate of characters with the other species of the genus.

Returning to the genus *Brachistella*. Any one making a study of the *Trichogrammatidae* will soon learn through experience that the greatest caution is necessary in deciding upon antennal segmentation, more especially in regard to the minute ring-joints. One will often be misled and great difficulty will be experienced when only one or two specimens are available. It would be too absurd then not to expect errors, not to be constantly revising and not to be always self-distrustful. For these reasons and also because I am completing a study of the family, a number of the genera are reexamined and some errors detected. Long practice has now made me less liable to error in describing these minute insects and more unerring in the detection of minute parts of structure than heretofore. *Brachistella* was originally described as bearing but one ringjoint; careful and prolonged examination of it will show, however, that there are two, the second appearing somewhat smaller than the first and united somewhat with the first funicle joint. The tibial spurs of the cephalic tibiae are absent.

2. A Reexamination of *Ittys* Girault.

Also this genus was originally described as bearing but one ring-joint in the antennae, qualified, however, by the statement „sometimes appearing as two (2) distinct joints.“ There are two ring-joints, the second somewhat closely attached to the funicle and formerly thought to be a rimmed portion of the base of the first funicle joint. There is also a median sulcus running the whole length of the thorax.

3. A Reexamination of *Abbella* Girault.

Likewise with *Abbella*; it was erroneously described in respect to the same parts. There are two ring-joints. This genus may have to be combined with *Brachistella*, its name taking precedence; its discal ciliation is the only character differing and I have reason to think that there will be found species that are intergrades. More has been stated in the first section. I have recently found a specimen of *subflava* Girault, the type of this genus, which partly inspired the preceding remarks, since the ciliation of this specimen was nearly an intergrade and puzzled me for quite awhile. It was a female, captured in a greenhouse at Urbana, Illinois, August 14, 1911.

4. The Resemblance of *Pterygogramma* Perkins with *Uscana* Girault.

These two genera are alike but the marginal vein in *Pterygogramma*

is distinctly longer, as long or nearly as the submarginal, thrice or more the length of the stigmal, while in *Uscana* it is only half the length of the submarginal and twice the length of the stigmal. Also in *Uscana* the ovipositor is short, inserted at base of distal half of abdomen, not exerted and the abdomen is short, not long and conic-ovate, the ovipositor long and prominent, its valves distinctly though shortly exerted as in *Pterygogramma*; also the discal ciliation of the fore wing is more dense.

5. The Characteristics of the *Trichogrammatidae*.

A student of those parasitic *Hymenoptera* grouped together under the name of chalcid flies soon learns to pick out the various groups, by the eye or more definitely by their habitus. Members of the natural families usually have distinct peculiarities of ensemble; an encyrtid looks an encyrtid, an eulophid an eulophid, a pteromalid a pteromalid and so on. Each gives a distinct impression. So a mymarid looks a mymarid and a trichogrammatid a trichogrammatid — in many cases. All members of this family of egg-parasites have a more or less characteristic appearance to the naked eye and a specialist soon gets to know this. Nevertheless, while one can recognise a chalcidid for instance with certainty without a great number of exceptions, in the case of trichogrammatids a larger number of exceptions occur and in a number of cases it will be impossible to say whether the insect is an encyrtid, an eulophid or a trichogrammatid without more careful examination of it. Thus, while there are always a certain number of individuals of all the families which do not partake of the ensemble of their particular family, with the *Trichogrammatidae* the number of individuals of this kind appears to be larger and most members of the family give an aphelinine or encyrtine impression. Roughly, our gross sense impressions serve the purposes of taxonomy since in most cases they reflect the resemblances which the members of a segregate usually possess; these resemblances throughout all organic nature usually meaning common descent and close relationship. A large group of closely allied species will give a gross impression of likeness, though when examined under the microscope they will be seen to differ greatly in their details falling into a number of natural genera many of which will be unlike in many important structures. Still the gross impression sums up, as it were, the true relations of the whole group, the lesser units affording many exceptions. Thus one may see an eulophid resembling so closely a *Gonatocerus* that it is impossible to detect which is which until closer scrutiny reveals the real differences. Hence, one will be often struck when collecting trichogrammatids with encyrtine and aphelinine impressions and it is impossible to prevent the idea arising that these gross impressions hint at a hidden relationship between the three. Scrutiny confirms this. Members of the family bear both encyrtine and apheline characters but the latter predominate and according to those principles enunciated above we

must conclude that the *Trichogrammatidae* are more closely related to the *Eulophidae*.

The *Trichogrammatidae* differ from all other chalcidoids, so far as I can ascertain under present circumstances and so far as I can remember from experience in bearing but three tarsal joints in the legs and lacking the strigil of the cephalic tibiae, the cephalic tibial spur most often absent, when present very minute and straight, not long, curved and forked at tip. These make up the sole characteristics of the family. All members of the family bear the thoracic phragma projecting well back into the abdomen which is always sessile. The postmarginal vein is always absent, the parapsidal furrows always complete, the axillae advanced into the base of the parapsides.

6. The Resemblances of *Japania* Girault and *Ufens* Girault.

Happening upon species of these two genera I was at once struck by their likenesses and thus lead to compare them. At first they seemed the same. *Japania* however, bears a shorter antennal funicle, its two joints short, transverse; the marginal and stigmal veins of the fore wings are longer but not very much longer; the principle difference between the two is greater than these, however, and lies in abdominal peculiarities. The abdomen in *Japania* is long, slender and conic-ovate, the ovipositor very long, inserted at base and slightly projecting beyond apex. In *Ufens* the abdomen is short, obliquely truncate behind, the ovipositor short, not inserted at base of abdomen but about at the middle of its venter or at the apex of the proximal half. The funicle joints in *Ufens* are subquadrate or only slightly wider than long, the funicle as long or longer than the pedicel. Moreover, in *Ufens*, the male differs from the female.

7. Cephalic Tibial Spurs in the *Trichogrammatidae*

Cephalic tibial spurs have been detected in five recently described Australian genera, *Chaetostricha flavipes* and *Uscana*; they have not been detected in *Oligosita*, *Tumidiclava*, *Aphelinoidea*, *Paratrichogramma* (Australian), *Ufens*, *Japania*, *Trichogramma*, *Neotrichogramma*, *Brachistella*, *Ittys*, *Pterygogramma* (Australian), *Uscanoidea*, *Abbella* nor one undescribed Australian genus. Members of all these genera have been examined but the possibilities have not been exhausted and the list may need correction.

8. Another Figure of *Trichogrammatoidea nana* (Zehntner).

In Wilhelm Krügers Das Zuckerrohr und seine Kultur. Magdeburg und Wien, 1899, p. 366, fig. 49, 1—3, there is given „Nach Zehntner“ a colored figure of the female and drawings of the male and female antenna, all enlarged. It is noticed that the female antenna is shown with two ring-joints, in this respect not agreeing with the re-drawn figure (from the original) given by myself in the Transactions American Entomological Society, Philadelphia, 1911, XXXVII,

pl. I, fig. 7, ♀. I have never seen the original drawing. This nonagreement of two drawings from the original necessitates a reiteration of the fact that the antennae of both sexes bear but a single ring-joint. I have reexamined a number of females of *T. lutea* Girault. The latter also bears a more or less distinct median sulcus on the mesothorax; its color is bright orange yellow with a black band across the base of the abdomen. None of the details of Krüger's figure of the adult are correct.

9. The Widely Distributed Genera of the *Trichogrammatidae*.

Of the known genera of this family, now numbering thirty-nine (two of which are as yet known in manuscript only) the following are common to Europe, North America and Australia, three widely separated countries: *Oligosita* Haliday and *Trichogramma* Westwood. The former has numerous species native to Australia and America and also several to the island of Ceylon. *Trichogramma* has species native to South America and a supposed species from Ceylon; it also has a species native to the Sandwich or Hawaiian Islands in the Pacific. Since the family has been more thoroughly explored in North America and Australia than elsewhere, we should not be surprised to find more genera common to both as such is the case. These genera are common to the two widely separated countries: *Oligosita* Haliday, *Trichogramma* Westwood, *Brachistella* Girault, *Aphelinoidea* Girault, *Tumidiclava* Girault, *Abbella* Girault, *Uscana* Girault and *Ufens* Girault. *Trichogrammatoidea* Girault is common to Australia, Java and Africa; the genus *Japania* to China and Australia. The new genera found in Australia appear to be peculiar to it as does also *Pteryogramma* Perkins.¹⁾

These are very striking facts. To one who experiences them for the first time a number of questions at once arise. How did these genera, though they may be thousands of years old, get first hold on lands so far apart and so effectually isolated one from the other. One of the ideas which struck me immediately was that they arose independently in each country. There is only one other alternative and that is that they all had a common origin and subsequently became widely distributed. But distributed how? We may argue that if a genus can arise from a common stock at one portion of the earth there is no reason why it should not arise at the same time or subsequently in another; but if an argument of that kind is made one must be able to support it with facts and after reflection I am unable to do this. Nor in my extensive reading have I ever seen any facts in favor of it. If we argue that the same genera can originate independently in different countries at different times we must also admit that both larger and smaller groups can do so. But if so originating why are they so closely alike their components. On this supposition, how can we explain

¹⁾ On the other hand North America appears to have not more than two genera peculiar to it.

the exceedingly close resemblance of North American and Australian species of *Trichogramma* and *Oligosita* and of species of other genera common to the countries. But, more than this. To suppose an independent origin forces upon us either one or two admittances which decide the question negatively or affirmatively. Either we must admit migration of the ancestors or else an entire independence of origin for each country. To admit the former is to decide in the negative. To admit an entire independence of origin involves a denial of the whole theory of common descent and the affirmation that life arose in each country independently and revolved there without any relation to other evolutions. But in order to admit this we must explain away a legion of facts such as the striking resemblances of species from the two regions, the occurrence of similar genera and other higher groups not only with great structural and other resemblances but with all the peculiarities of habit. The thought persists, however, that it is just as possible for life to arise in many places at one time as it is for it to arise only in one place¹⁾ and if the possibility is admissible then it is quite conceivable that, the fundamental conditions of life being the same in all places, the same evolutionary productions resulted. The conditions for life are practically identical all over the earth just as the various forms of life are united in that they are merely different expressions of the same fundamental substance. It is conceivable, therefore, that the same kind of evolution should take place in different countries, producing much the same kind of life and often quite the same. This is true for development in man, since the most ancient and widely separated civilizations are found to have arisen quite independently and yet are of the same kind, differing only in their expression. But is not this fact also an argument for common descent? Does it not also go to show that given the same traditions the same response is given to the same stimuli, the expressed response differing only in its details? This same tradition certainly strongly implies common origin. Although we can at first see no actual impossibility that evolutions may have arisen independently, the facts are too patently in favor of one common origin to entertain the other. The whole experience of naturalists leads to its acceptance and experience is the only criterion of reason. The productions of no two separated countries are the same which would not be expected were evolutions of independent origin and parallel in productions or nearly so; the distribution of closely related species in one country is the same as the distribution of similar species over the earth, one species gradually fades out and its place is taken by another; distant countries in the same latitude with nearly the same physiographical features and climates have widely different fauna; the presence of almost impassible barriers to migration is closely related to the presence of distinct

¹⁾ Some naturalists think it extremely likely that primitive life arises continually and is still doing so, whenever the conditions become favorable. After seeing the evidence, I am of the same opinion.

fauna; in neighbouring islands, many species are found common to both while others are different, yet very similar; similarity of species is inexplicable unless due to heredity, since the latter is the only cause known to produce fundamental likenesses in nature; migration of forms has actually been proved and in modern times has frequently occurred through the conscious or unconscious agency of man; species have a tendency to increase and spread indefinitely; the time for migration to have taken place is certainly abundant as are also the means for it; islands comparatively near continents appear to have been stocked from the latter, since their fauna resemble more that of the adjoining continent. All facts prove then that genera and species have originated from a common stock at one place. The argument in favor of independent evolutions, namely, that evolutionary factors are the same over the whole earth, breaks down at once when it is remarked that the strongest of these factors, heredity, is the cause of all resemblances and if it were not they would be meaningless for us.

Correlated with wide geographical distribution we usually find dominance, abundance in numbers of species and much variability and adaptability; also with large and widespread genera usually some one of the species is dominant, very numerous in individuals and very variable. *Trichogramma* illustrates this for the genera, *T. minutum* for the species. Species of large genera, too, are most often very much alike and I have been much surprised at this close resemblance more than once both in *Trichogramma* and *Oligosita*.

None of the genera of this family peculiar to Australia are peculiar to the family, that is, differ more from the genera of other countries than does any genus of the family differ from any other genus.

10. The Striking Resemblance of Some Australian and North American Species.

Greater surprise could hardly be produced than was mine when I first saw an Australian *Oligosita* now named in manuscript. It is so much like the striking North American species *sanguinea* that I cannot separate them at all in regard to details of structure, nor in details of the brilliant red coloration. The difference between them, however, is as blatant and striking as their close resemblance. It consists of a broad and conspicuous white band across the base of the abdomen contrasting with the blood-redness of the body. It so happened that I had already found the species *americana* in Queensland and consequently was looking for *sanguinea*, since it appears to be associated with the other species. Thus my surprise was enhanced. In Australia, there also occurs another species which resembles *americana* very much and I am doubtful as to its validity. The other Australian species so far seen are not in any way peculiar excepting one, which is characterised by its minuteness, by bearing a median sulcus along the thorax and by being associated with minute yellow mymarids and eulophids in abundance upon the foliage of a broad-leaved *Eucalyptus* in forests.

Species of *Trichogramma* appear to be scarce in Australia though there is one species which must be widely distributed along the east coast and numerous in individuals since I have frequently captured it. Again it shews the great resemblances between the species of the two countries. At first identified as the wide-spread *minutum* of Riley, I was lead finally to consider it distinct, though the differences certainly are minute; this must be expected with this family, however. There are also Australian species of *Tumidiclava*, *Abbella*, *Aphelinoidea*, *Brachistella*, *Uscana* and *Ufens* all of which closely resemble their North American congeners, some very closely. It may be that the latter are geographical variants of those Australian forms wicth they so closely resemble, which had migrated and subsequently varied in their new life; but it may be just as likely that they descended from some one ancestor of the genus which had migrated, prospered and given rise to diverse species. Thus, I do not think that these species of the two continents which resemble each other more than they do any other species of the genus, are necessarily directly related but have of necessity a common ancestor. Heredity and its action, however, must incline us to believe that the great likenesses of the widely separated species means direct relationship, however difficult it may be to believe it. This the more so, since the liknesses are structural and fundamental. In the heat of the tropics, the long exposure to great dryness and to great wetness and the brilliancy of the sun, it should be expected that the species abounding ther ewould be more intensely colored than with the species living in a more temperate climate where the light is less intense and life more sluggish. But, the more uniform conditions in the tropics seemingly counteract to some extent the tendency which the factors named would have upon coloration and as a whole there is not a great contrast between North American and Australian species of the family.

The difficulites in explaining how, many centuries ago, these minute insects scattered themselves over the earth are great, still the available explanations are not highly improbable and might well have occurred. There can be no doubt that in recent years some of the species like *Oligosita americana*, *Abbella subflava*, *Trichogramma minutum* and *Trichogrammatoidea nana* have been carried from one country to another by commerce with their hosts which in turn were transported within their host plant. In the case or the first two species, there is very little doubt but that they were introduced into Australia for instance with their hosts in cultivated wheat and it is highly probable that the last was likewise introduced with its host in connection with sugar-cane. None of these species appear to be common in Australia and they were taken in localities which makes the above the more likely. Distributions of a like kind have been intentionally made by entomologists and this proves that its occurrence is easily possible at the hands of unconscious men.

But thousands of years ago commerce was very much restricted and infinitely lower. At one time it must have been absent. Whole

continents remained unknown to others and were never visited. Civilizations were restricted to a few centers, were not advanced and the great majority of men were living in a state of savagery, roaming from one part of a continent to another, keeping no plants and animals under cultivation and therefore apparently having little or nothing to do with the unconscious agency of transporting minute insects from place to place. Occasionally, there must have been long migrations of bodies of men, even from one continent to another perhaps always through natural or accidental causes, certainly so at first. These migrations seemingly could in no way have affected the dispersal of *Trichogrammatidae* from one continent to another, since at the time we have in mind men would scarcely have carried anything in bulk from one continent to another but must have depended upon such food as would barely suffice for the journey, or that could be obtained on the way; the journey in most cases would require a long period of time. Nevertheless, our imagination cannot help seeing possibilities even here. Parts of plants with the stems and foliage attached would have been carried along as food, perhaps, or else fruits containing the eggs of insects infested with trichogrammatids; or else grasses might have been carried along either for crude bedding or for some other purpose. All of these could easily have happened. In the rapidity of modern times it is a common experience for entomologists to send fruit infested with the parasited eggs of an insect over long distances with certainty that the parasites will survive; from one continent to another this has been done by the use of cold storage and the knowledge of this last fact, opens still further the early possibilities of unconscious dispersal by men followed by subsequent establishment of the insects so dispersed; human migrations into temperate climates during the winter for instance, accidental or otherwise.

But thousands of centuries of years must already have elapsed since the migrations of the ancestors of the existing species of different portions of the earth and man, consequently, must have been in a very low stage of development. Though, it must certainly be true that even then he was migratory and may have had more or less unconscious agency in the distribution of these and other forms of life, yet it is equally, if not more probable, that other factors were concerned in a greater degree. The dispersal of their hosts was one of the factors of the greatest importance. The parasites followed their hosts and at first probably did not extend beyond their habitat. How the hosts became scattered would take too much space for discussion here but the means are not unlike those for the parasites. These minute insects fly and must at times be blown enormous distances by the wind, as during gales and storms; females thus transported, being parthenogenetic and adaptable, would in some cases at least, readily find a host and then become established in a new region. This operation repeated century after century offers a likely explanation for dispersal over continents and even adjoining islands. The dispersal from continent to continent has already been explained. The mere fact that in our

time we can actually trace the dispersal of these insects from continent to continent gives evidence that its method is quite efficient for the purpose and to prove that some such manner was the natural way centuries ago, all that is necessary is to prove that the wind blew centuries ago, that man existed then, fed upon plants, roamed about and migrated; that our ignorance in regard to means of dispersal is profound; that species then still had the tendency to increase indefinitely and to extend their habitat; that plants were transported from place to place by animals and otherwise and fruits by birds and that an enormous time has elapsed. For the migration must have gone on very slowly. I think all of these facts are admitted. Can human reason find any other explanation to fit the facts? Thus, species either have or have not originated at one place and dispersed therefrom; if we conclude that they have not, we not only must deny a legion of facts but base the conclusion an a priori grounds; but to conclude that they have is to satisfy reason based on experience the only method whereby truth is known.

11. Criticism of My Table of Genera to the Family.

I have sent in a manuscript to be published in the Bulletin of the Wisconsin Natural History Society, giving a new, and in my opinion, better arrangement of the groups of the *Trichogrammatidae* and since I have been informed that it will not be possible to see the proof of this paper before it is published the opportunity is taken in this connection to correct some unfortunate errors discovered after the manuscript had been mailed.

Since, I have worked up the Australian fauna as represented by this family and while doing so noticed the errors in my former descriptions of certain genera; these have been noticed above but I again consider them in respect to this paper on the genera. In the tribe Chaetostrichini, the genera *Brachistella*, *Ittys* and *Abbella* should be removed from their position in the table to form a first section, headed „Antennae 9-jointed, with 2 ring-joints, the funicle 2-jointed“. A second section headed „Antennae 8-jointed, with one funicle joint“, should include the genus *Brachista*, while a third section headed „Antennae 8-jointed, with 2 funicle joints“ should consist of the genera *Ufens* and *Japania*; the other sections follow as in the table. It should be further noted, however, that the ovipositor of *Pterygogramma* Perkins is not exerted and that this genus should follow *Uscana* in my table.

12. Criticism of Perkins' View Concerning the Relations of the *Oligositinae* of Ashmead.

Although, I certainly agree with Doctor Perkins (Bull. No. 1, Division of Entomology, Hawaiian Sugar Planters' Association, Honolulu, Part VI, p. 192) when he implies a close relationship bet-

ween the *Eulophidae*, *Mymaridae* and *Trichogrammatidae*, yet I must dissent from his statement to the effect that the Ashmeadean *Oligositinae* should be included with the *Eulophidae* and the other subfamily — the *Trichogrammatinae* Ashmead — left to itself as a distinct family merely for the reason as is implied from their nature, that the fore wings bear a somewhat peculiar discal ciliation. I have attempted to explain the nature of this ciliation in the first section and I think none can doubt but what some closely allied genera differ only in this particular. Also, I have attempted to explain why I consider the Ashmeadean subfamilies to be unnatural and also how all of the genera of the group form a compact segregate, divisible only on antennal structure and wing venation.

More than this, all of the genera have the same habit, all bear the same reduced tarsal structure and the reduced cephalic tibial spurs, the strigils absent. Thus, if the segregate is to be joined to the *Eulophidae* all of the genera must be taken into the alliance or none. In regard to the structure of the tarsi, Perkins (Ib, p. 191) implies that a reduction in the numbers of joints is of little taxonomic value. This is true as regards the present families allied with the *Trichogrammatidae*, since other characters are more constant for larger groups of species, the number of joints in the tarsi being constant only for groups of subfamily rank. This would seem to make it necessary to subordinate the *Trichogrammatidae* to the *Eulophidae* as a subfamily. Still, it must be remembered, that three-jointed tarsi occur in no other group of the *Chalcidoidea* and it must, therefore, be given more weight than a reduction in tarsal structure would require otherwise. This greater reduction, combined with the development of a peculiar venation in one group of genera, peculiar wing ciliation in many genera, the absence of strigils and the uniformity in habit still induces me to hold aloof for a while at least before insisting upon any such subordination though I think it may come in the end.

13. Species of the Family Common to Australia and North America.

These species of *Trichogrammatidae* have been found in North America and Australia; *Oligosita americana*, *Abbella subflava* and *Trichogramma minutum* Riley, all captured by myself in North Queensland, the first in the Southwest of the same state. Their presence may be accounted for, since they are associated with crop plants, the first two with wheat and the last with maize. The *Trichogramma*, which is nearly cosmopolitan, was captured in a small isolated mining community in the forests thirty miles back from the coast, but I have very little doubt that maize is or was grown there and that one of its hosts is or was present, for instance *Heliothis obsoleta*.
